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ST. DAVID'S ROCKS AND UNIVERSAL LAW.

A DISCUSSION of the St. David's rocks has been opened in the Geological society of London by Prof. A. Geikie, director of the Geological survey of Great Britain and Ireland, which possesses great interest to all persons engaged in the study of the older crystalline rocks. The St. David's rocks, according to Dr. Hicks, consist of three distinct pre-Cambrian formations in ascending order: the Dimetian, composed of crystalline, gneissic, and granitoid rocks; the supposed unconformable Arvonian, formed of felsites, quartz porphyries, h  lleflintas, etc.; and the Pebidian, supposed to be unconformable to both the preceding, and made up of tufas, volcanic breccias, and basic lavas. The Cambrian is said to overlie all these, and to have a basement conglomerate composed of their ruins.

Dr. Geikie maintains that the Dimetian is an eruptive granite, which has disrupted and altered the Cambrian strata, even above the horizon of the supposed basal conglomerate. Besides a pebbly quartzite formed of fragments torn from the Cambrian conglomerate and greatly indurated, no rock, except diabase, is found, according to him, in the granite area; and this occurs throughout the entire district. The granite cuts through successive horizons of the Cambrian strata, and is younger than all of that formation in the district. The Arvonian consists of quartziferous porphyries, or elvans (associated with the granite), and of the metamorphosed strata adjacent. The Pebidian consists of a series of volcanic tufas and breccias, with interstratified and intrusive lavas.

Geikie holds that the Pebidian is an integral part of the Cambrian. It is cut by the Arvonian porphyry and Dimetian granite, and is therefore older than these. It is covered quite conformably by the Cambrian conglomerate, and not unconformably, as Hicks claimed. Seams of tufa are interstratified at various horizons in the conglomerate and strata above. This Cambrian conglomerate, instead of being composed of fragments of the Dimetian, Arvonian, and Pebidian, consists almost entirely of quartz and quartzite; "only four per cent of fragments having been found to have been derived from some of the projecting lava-islands underneath it." Professor Geikie then claims that the names Dimetian, Arvonian, and Pebidian "had been founded on an error of observation, and they ought to be dropped out of geological literature."

Prof. A. Renard also states that he had examined these rocks microscopically, in concert with Drs. Zirkel of Leipzig, and Wichmann of Utrecht; and their conclusions are, that the so-called Dimetian rock is unquestionably a true granite (eruptive). The quartz porphyries were like the contact specimens of granite, and believed to be such. The tufa found in and above the conglomerate is a true tufa, and not a mere superficial waste of older volcanic rocks. The observed foliation existed above the conglomerate as well as below.

That the questions involved in Dr. Geikie's position are deeply interesting, is manifest from the fact that some fourteen persons joined in the discussions which followed its statement. These questions are of equal interest to American geologists and petrographers, since they are the same as those the present writer has raised regarding eastern Massachusetts, — a district similar to St. David's, — also similar to those raised by Professor Dana against the Taconian, Montalban, and Huronian, in New England; by Dr.

Selwyn, concerning the Norian, Montalban, and Taconian, in Canada; by Messrs. Whitney, Selwyn, Winchell, and Wadsworth, with respect to the Lake Superior geology; and by Geikie and Wadsworth, regarding the Fortieth parallel exploration.

The writer has nowhere seen any general statement of the bearings of these questions; and it may be briefly indicated here what some of them seem to him to be. They seem to be involved in the distinction between one universal law, moving in a uniform, definite direction, and recurrent phenomena or special creations and conditions. Under the latter view there seems to belong the belief that detrital or chemical sediments are returned to eruptive forms; that eruptive rocks are of chemical or sedimentary origin; that these were different in pre-tertiary time from what they were in the tertiary; that certain geological periods are marked by certain kinds of rock; that the azoic system has been subdivided upon natural principles; that there have been recurrent periods of heat and cold. This view includes the theory of the metamorphic origin of granite, the present geologico-mineralogical classification of rocks, and embraces uniformitarianism, catastrophism, plutonism, and neptunism.

The other maintains the existence of a universal law, which should be the guide in all investigations, — a law, which, in its more special applications, Professor Whitney has endeavored to illustrate in his Climatic changes, and Sir William Thomson in his papers on the age of the earth and sun, — a law which the present writer has tried to express in his petrographical work. It is regarded as the law which will one day be completely worked out, and in accordance with which our views in history, philosophy, science, — all branches of human knowledge, — will then be reconstructed. The expression of the law varies in different ages, but for the physical universe it seems best formulated at the present time by Sir William Thomson: The degradation and dissipation of energy, the passage from the unstable towards a more stable condition, the tendency to harmonize with the environment, — the law under which the universe has moved from the beginning, and under which it will continue its course uniformly towards the end; it assumes that no turning-back can occur, and that no energy once lost can be restored, except by the same Almighty Power which gave it birth.

M. E. WADSWORTH.

THE HUMAN REMAINS OF THE BONE-CAVERNS OF BRAZIL.

THE discovery by the late Dr. Lund of human remains associated with the extinct mammalian fauna of the caverns of Lagoa Santa in the province of Minas Geraes, Brazil, made famous by his researches, has, until recently, passed almost unnoticed among ethnologists. Dr. Lund's statements in the communications which accompanied the human bones, sent to the societies of Rio de Janeiro and Copenhagen, are, I believe (I write without the documents for reference), unqualified as to the direct association of the human with the extinct mammalian remains, and have been received as conclusive by prominent ethnologists. There can be no question of Dr. Lund's perfect good faith in the matter; but it may be asked whether, forty years ago, such care as is now considered necessary in such investigations would have been exercised, even by so able and conscientious an observer as Lund is recognized to have been.

So long a time has elapsed, that it is now difficult to verify the exact conditions under which the bones